August-September 1971

EMO

Fallout Survey of Canada

Industry's Role in C.D.

Parish War Plan

Disaster Prevention - Japan

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The EMO NATIONAL DIGEST publishes six editions annually to provide current information on a broad range of subjects dealing with civil emergency planning. The magazine is published in English and French and may be obtained by writing to the Canada Emergency Measures Organization, Ottawa, Ont. K1A 0K2.

In addition to publishing articles which reflect Canadian Government policy the Digest may also publish articles by private individuals on subjects of current interest to the emergency measures programme. The views of these contributors are not necessarily subscribed to by the Federal Government.

Editor: A. M. STRATON

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FALLOUT SURVEY OF CANADA

A comprehensive report on essential studies necessary to a national public fallout shelter program was developed by K. G. Farrell and A. G. Jordan of the Public Fallout Protection Division of the Canada Emergency Measures Organization. This edition of the Digest carries a slightly revised reprint of sections I to III. Introduction: Fallout Protection Survey of Canada; and Analysis of Results.

Section I. Introduction

In 1964 the Government of Canada agreed to a recommendation that a national survey be carried out of all existing buildings to identify the potential fallout-protected spaces available. This survey entitled the Fallout Protection Survey of Canada, and now completed, provides:

- a national inventory of existing potential fallout shelter space
- information on which to carry out necessary shelter planning
- information on which recommendations can be made concerning future development of a national fallout shelter program

The development of the Fallout Protection Survey of Canada resulted from a series of studies in Shelter Survey Techniques during the period 1959-1964. These studies are summarized as follows:

1959—Brockville Pilot Study: Initial survey, by sampling, to determine the feasibility of survey techniques in conjunction with a preliminary method of computation.

1961—Survey of Federal Buildings: Conducted to evaluate the fallout protection available in basements of federally owned buildings. In the Province of Ontario, the first computer program written for calculation of protection factors was developed by the Department of Highways of Ontario, in conjunction with the Department of Public Works of Canada.

1962—Survey of Mines: A preliminary survey to determine the suitability of using mines as protected space. The principal factors under consideration were habitability, access and emergency power supply.

1964—Alberta Pilot Study: The purpose of this pilot survey was to:

- Develop fallout protection survey techniques which could be applied to a national survey.
- Determine the amount of fallout protection in the Province of Alberta, in terms of protection factor and space which could be made available for public use.

1965—Analysis Study No. 1, Alberta Region: This first analysis study on fallout protection, was aimed at estimating the costs of developing existing shelter potential, but without regard to geographic location.

1969—Fallout Protection Survey of Canada—Completion: This event represents the culmination of a series of projects designed to determine existing national resources that may be made available for protection of the public against fallout gamma radiation in a nuclear war emergency. Analysis of the results of this work together with details of the inventory, provides the basic information necessary for shelter planning and programming.

The present document—The Analysis of Results of the Fallout Protection Survey of Canada, includes among other matters, an attempt to correlate the risk of fallout to fallout shelter distribution as revealed by the survey. The study does not take into account the potential shelter space that may be available in the various operating and disused mines across the country or the possible fallout protection that may exist in private homes. This analysis is essentially an examination of the number of potential communal shelter spaces located and identified in both public and private buildings across Canada.

In order to provide a better understanding of the results of this study, a brief description of the Fallout Protection Survey of Canada has been included as Section II.

Section II. Fallout Protection Survey of Canada

Purpose and Scope

The purpose of the survey was to determine the amount and quality of existing *potential* fallout shelter space that could be made available to the public in a nuclear war situation, on this continent.

The survey included all categories of buildings and structures having a minimum protection factor of 10 and a minimum floor area of 1000 square feet, with the exception of:

- All DND owned and operated buildings and structures.
  Note: DND staff surveyed these departmental properties in 1961.
- All residential dwellings including detached or double homes, town housing or row housing, duplex, triplex, fourplex and apartments with fewer than seven units.

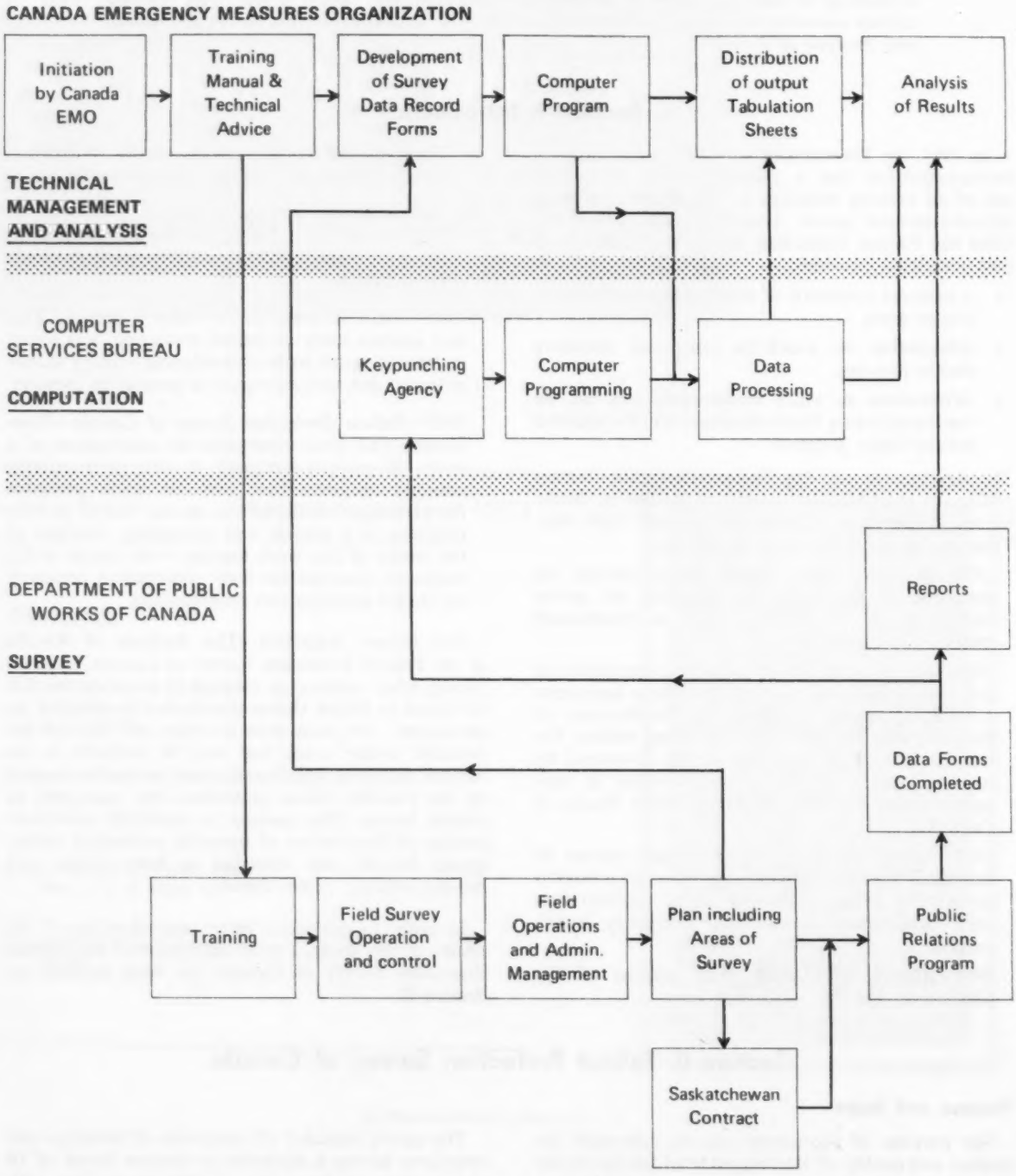


Figure 1. Survey Work Flow

All floor space above and below ground was considered and environmental factors recorded for each surveyed building. Special-entry cards were used to record essential services buildings such as relay stations and generator buildings.

Survey Response

In June, 1966, over 300 people were employed on the task of gathering building data for the Fallout Protection Survey of Canada. This task could not have been carried out without the adequate coverage given by the news media and all persons who generously gave permission to allow survey teams on their premises. Public reaction to this project was most positive and resulted in a great deal of interest as indicated by the many questions concerning the survey.

In addition, full cooperation was received from private industry, provincial and municipal governments.

While the project was widely acceptable, some buildings were excluded because of commercial and industrial security considerations.

Organization

The survey work flow and related areas of responsibility are shown in Figure 1. The three main areas of Survey; Computation; Technical Management and Analysis were conducted by the Department of Public Works of Canada, the Computer Services Bureau and the Canada Emergency Measures Organization. A departure was made from normal survey procedures during 1967, when the Department of Public Works of Canada contracted with the University of Saskatchewan to carry out field survey work in the Province of Saskatchewan. The value of the contract was $85,000.

Survey work has not been carried out in the Yukon and Northwest Territories or Canadian Embassies and other buildings abroad.

Interim and Final Survey Results

The Middle East crisis of 1967 gave impetus to all aspects of civil emergency planning, especially with regard to crisis action planning. The inventory of potential shelter space at that time was incomplete, yet it seemed appropriate that the recorded information be made readily available. Subsequently, interim survey results were produced and held in readiness for any demand that might arise should there be further deterioration of the international situation.

In May, 1968, final survey results for all provinces except Quebec and Ontario, were produced and distributed. Because data collection was still continuing in the Provinces of Quebec and Ontario, interim survey results were sent to these provinces. The distribution of survey results enabled provincial and municipal engineering staff to become familiar with the survey result format and interpretation of data. Final survey results were issued ultimately to Quebec and Ontario during March, 1969.

Updating

A pilot updating survey was conducted in the Province of Alberta in fiscal year 1968/69 to identify problems likely to occur in updating existing records. On completion of this pilot survey, revisions were made to data processing routines and to the Annual Updating Survey Procedures.

Although a large number of new buildings and structures had been erected throughout the country since the survey began, the amount of field survey work was restricted by the funds available. During fiscal year 1969/70, some updating survey work was carried out in the Provinces of Quebec, Ontario and British Columbia. In British Columbia, the survey was completely updated for that province. However, work in Ontario and Quebec was restricted to the peripheral areas of Toronto and Montreal.

Limited funds are being made available to continue updating surveys within each fiscal year.

Field Survey Statistics

For the purposes of the survey, provinces were divided into Zones and Subzones. Figure 2 gives the number of zones and subzones in each province. A bound set of final survey results has been issued for each subzone which contains an acceptable 'building part'. A building part may constitute a whole structure or a portion of a structure which has been subdivided for computer purposes.

Political Division	Total Number of Zones	Total Number of Subzones
Newfoundland	1	1
New Brunswick	2	25
Prince Edward Island	1	1
Nova Scotia	3	20
Quebec	8	47
Ontario	7	50
Manitoba	3	65
Saskatchewan	9	13
Alberta	3	112
British Columbia	6	102
Totals:	43	436

Figure 2. Provincial Zones and Subzones

An important consideration in the preliminary planning and development of the survey was the magnitude

and extent of the required field survey work on a nation-wide basis. This is reflected in Figure 3, which shows, for each province, the total number of structures surveyed, the number of building parts recorded for these structures, and other pertinent details within the scope of the survey.

Political Division	Survey Completion Date	Structures Surveyed	Building Parts Recorded	Acceptable Building Parts
Nexfoundland	Dec. 1966	1965	2785	1477
New Brunswick	Sept. 1966	3940	5741	4065
Prince Edward Island	July 1966	484	642	474
Nova Scotia	Dec. 1967	1582	2091	1827
Quebec	Mar. 1968	18989	27957	25003
Ontario	Oct. 1968	28548	54687	47201
Manitoba	Sept. 1967	3373	5258	4543
Saskatchewan	Sept. 1967	3070	4209	3221
Alberta (Pilot Survey)	Sept. 1964	3310	4430	3657
Alberta (Updating Survey)	Oct. 1968	434	557	420
British Columbia	Sept. 1968	4704	6813	5536
Canada	Mar. 1969	70399	115190	97424

Figure 3. Survey Task Record

In the survey, each building part was recorded separately on a data collection sheet which had 406 recording boxes for coded entries; the location of the building was then sketched on the reverse side of the sheet.

It is estimated that over 40 million recording boxes were completed to record the data for the Fallout Protection Survey of Canada.

Costs

Planning of the main survey was carried out during the fiscal year 1965/66 with field work commencing in five provinces in the Spring of 1966. The majority of the field work was completed during the Summer months of 1966, 1967 and 1968, using students on the field survey teams.

Essentially, expenditures were allocated to two major functions; field survey work and data processing. Figure 4 shows a breakdown of expenditures for this project for each of these two functions from fiscal year 1964/65 to fiscal year 1968/69. The expenditures incurred for the Alberta pilot study are included because they constitute an essential part of the whole survey and analysis.

Fiscal Year	Field Survey Work	Data Processing	Total
1964/65	$ 90,000	$ 10,000	$ 100,000
1965/66	139,000	38,000	177,000
1966/67	992,000	46,000	1,038,000
1967/68	447,000	66,000	513,000
1968/69	165,000	55,000	210,000
Total:	$1,833,000	$215,000	$2,038,000

Figure 4. Expenditures—Main Survey

Expenditures for the updating survey work carried out during the fiscal years 1969-71 in the Provinces of Quebec, Ontario and British Columbia were as follows:

Fiscal Year	Field Survey Work	Data Processing	Total
1969-70	$45,000	$7,000	$52,000
1970-71	58,500	7,500	66,000

In summary, the following statistics are noteworthy:

MAIN SURVEY (1965-69)

- 70,399 structures were surveyed at an average cost of $27.32 per structure.
- Cost to completely process 115,190 data collection sheets averaged $1.81 per sheet.
- Average cost for field survey work and data processing was $17.69 per record. (fig. 3).
- Cost per head of population for the Fallout Protection Survey of Canada was 9.7 cents.
- Cost per potential shelter space, 3.7 cents.

UPDATING SURVEY (1969-70 only)

- 1,360 structures surveyed at an average cost of $26.90 per structure (to January 31, 1970).
- Average cost for field survey work and data processing was $23.50 per record.
- Cost per potential shelter space, 2.9 cents (considering only spaces with PF 50 and better).

Section III. Analysis of Results

Introduction

Summary figures of the final results of the Fallout Protection Survey of Canada indicate that there are about 21 million potential fallout shelter spaces with protection factors of 50 or better and about 31 million with protection factors of 25 or better. On a national basis, these figures may not appear to be meaningful but when correlated with fallout risk areas, likely target areas and the relative geographic location of these shelter spaces, to that of the population, they become extremely significant.

In November 1969, the paper, "The Threat to Canada 1970" (Digest October — November 1970), was produced to provide civil emergency planners with an estimate on which to base their program and their contingency plans for a war emergency. This paper has been used as a basis for defining and locating the various risk areas of Canada, to develop a risk oriented analysis. The emphasis of this analysis, therefore, is on the correlation of risk to distribution of shelter space and population. It should be noted, however, that the existing deployment of missile sites by the United States along its northern border has not been considered in this study, since adequate information was not available at the time of preparation.

General Analysis Considerations

Population figures used in this study were developed from the latest information available from Statistics Canada and adjusted to match the 1970 population totals. Some discrepancies may exist in these figures at the Emergency Government Zone level, but the DBS figures are sufficiently accurate for the purpose of this study. Population figures for those people likely to be subjected to direct weapon effects were taken to be the likely target metropolitan area figures. Discrepancies may also exist here, but they should not be too significant.

Population Distribution by Risk Area

Population figures developed for this study, show that about 11½ million people are located outside likely metropolitan target areas. Of these, 4½ million are located in high fallout risk areas (see Figure 5) where, in the event of a nuclear attack, there is a high probability that the 14-day gamma radiation dose will exceed 5,400 roentgens. More than 2 million people would probably be subjected to 14-day doses varying from 5,400 roentgens down to 820 roentgens and a further 4 million subjected to something less than 820 roentgens.

Four risk areas were used in this study and they are compatible with the risk areas defined in "The Threat to Canada 1970" paper.

DIRECT — metropolitan areas of likely target areas.

HIGH — areas where there is a high probability of the unattenuated 14-day dose being in excess of 5400 roentgens. Although this category includes those areas which may be exposed to much higher radiation intensities, it is realized that such areas would have to be dealt with separately.

MEDIUM — areas where the unattenuated 14-day dose is likely to be in excess of 820 roentgens but less than 5,400 roentgens.

LOW — areas where the unattenuated 14-day dose is likely to be less than 820 roentgens (This risk area embraces the remaining areas of each province.)

Risk Area	Population
Direct	9,592,000
High	4,518,000
Medium	2,327,000
Low	4,774,000
Total	21,211,000

Figure 5. Population Distribution by Risk Areas

The risk area population distribution characteristics of Canada resemble those of Ontario, Quebec and Alberta, but are quite different from those of other provinces. This is a result of the variation of risk across the country and it indicates that public protection requirements of each province may differ somewhat according to risk.

A curve at (Figure 6) shows the distribution of population surviving direct effects by risk area and the percent population that would be at risk to various unattenuated 14-day doses of gamma radiation. The curve gives only a general indication of the likely distribution of population by risk areas and therefore, should not be too precisely interpreted.

Protection factor levels marked on this curve indicate the percentage of people surviving direct effects that would be sufficiently protected to limit the 14-day exposure dose to 200R or less. For any given point on the curve, the protection factor required to limit the 14-day dose is derived as follows:

$$\text{Protection Factor (PF)} = \frac{\text{Unattenuated Dose}}{\text{Dose Limit}}$$

For example, if a 14-day dose of 200R is not to be exceeded, a protection factor of 25 would satisfy this requirement for about 58 percent of the population surviving direct effects (about 6.7 million). If the 14-day dose is to be limited to say, 100R, then a protection factor of 50 would be needed to satisfy this requirement for the same 58 percent of the population. These figures are intended to illustrate the use of the curves and should not be interpreted as constituting recommended levels of protection.

POPULATION SURVIVING DIRECT EFFECTS

DISTRIBUTION BY RISK AREA

14 DAY DOSE – R			TOTAL SURVIVING DIRECT EFFECTS
5400 R	820R – 5400R	820 R	
4,518,000 39%	2,327,000 20%	4,774,000 41%	11,619,000 100%

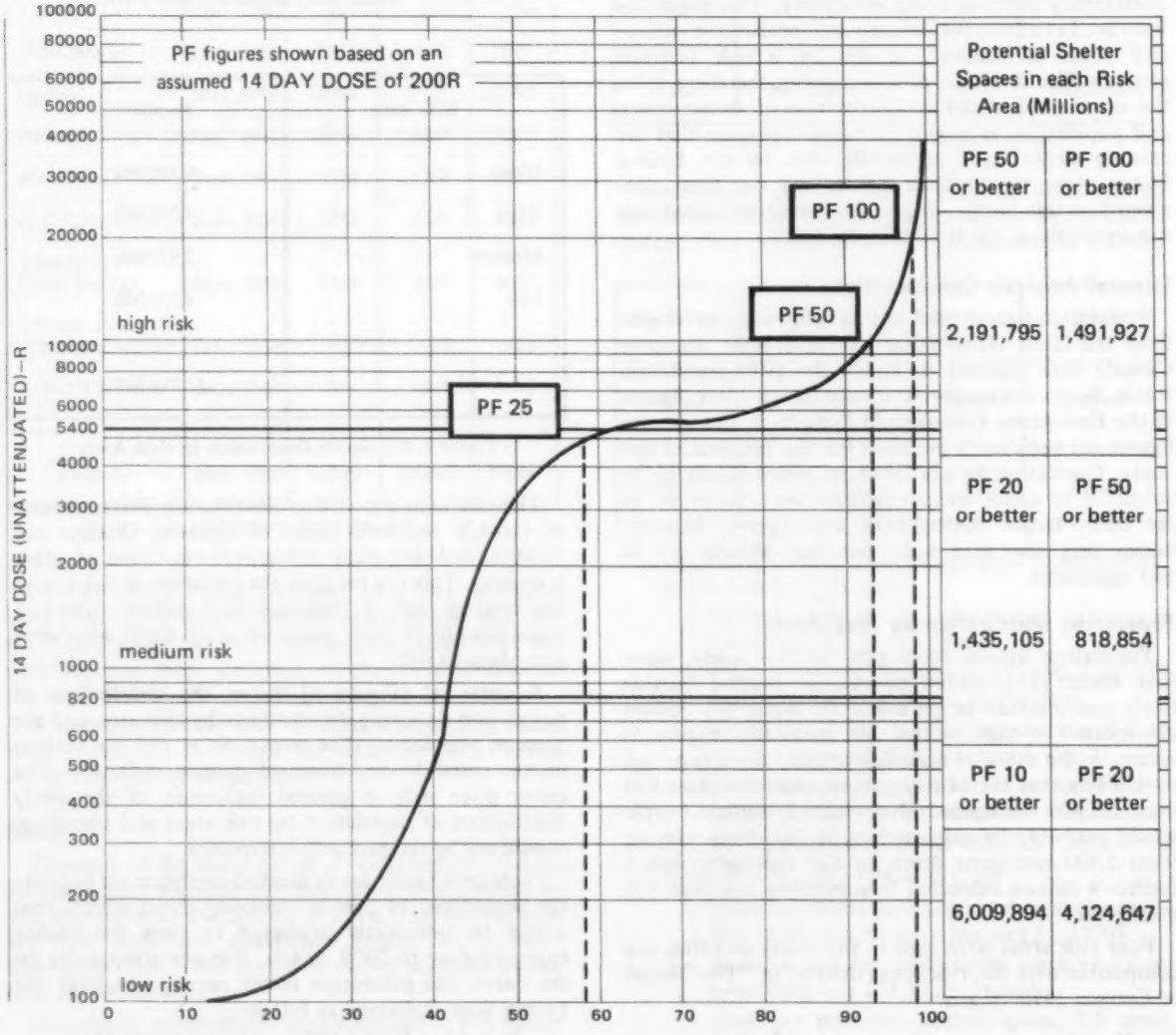


Figure 6. Percent (of Population surviving Direct Effects)

Protection Factors equal to or better than	Existing Potential Shelter Spaces
100	15,184,699
50	21,256,457
20	36,555,040
10	53,785,552
Total	53,785,552
Population	21,211,000

Figure 7. Potential Shelter Spaces

Potential Fallout Shelter

Of the 21 million potential shelter spaces in Canada, with protection factors of 50 and better, more than 15 million of these are located in potential target areas. The total population of these potential target areas is somewhat in excess of 9 million, indicating a probable surplus of shelter. In other areas the situation is generally the reverse. Figure 7 shows numbers of potential shelter spaces in Canada for given minimum protection factor levels.

These population—versus—shelter figures clearly indicate a significant amount of existing potential fallout shelter space. Nevertheless, it cannot be concluded from these figures that an adequate level of shelter space is available for the total population. The disparity is due mainly to localized deficiencies and surpluses of potential shelter space when equated to all of the various degrees of risk and population densities.

Figures 8, 9 and 10 contain details of provincial distribution of potential fallout shelter space by protection factor category, agency (that is, building ownership category) and type, as classified by the National Building Code.

A proportional graphic representation of the distribution of shelter spaces by agency and type is shown in Figures 11 and 12.

Political Division	Protection Factor				Provincial Total	Provincial Population 1970 Levels
	10-19	20-49	50-99	>100		
Newfoundland	184,980	133,151	28,741	106,480	496,879	516,000
New Brunswick	458,050	252,806	109,104	219,809	1,039,769	623,000
Prince Edward Island	58,421	28,012	7,089	20,794	114,316	110,000
Nova Scotia	275,531	270,042	83,763	203,849	833,185	765,000
Québec	5,702,974	4,930,748	1,155,267	6,037,366	18,625,059	6,004,000
Ontario	7,170,072	6,636,137	1,498,840	5,837,393	22,328,569	7,567,000
Manitoba	789,761	646,433	248,590	702,573	2,387,357	978,000
Saskatchewan	431,681	402,646	146,698	409,142	1,390,167	948,000
Alberta	836,048	792,434	287,039	784,000	2,699,521	1,586,000
British Columbia	1,322,944	1,206,174	478,269	863,293	3,870,730	2,116,000
PF Category Totals	17,230,512	15,298,583	6,071,758	15,184,699	53,785,552	21,211,000

Figure 8. Potential Fallout Shelter Spaces—Total Number from Survey Data (Based on 12 sq. ft./person)

Distribution of Shelter Spaces by Risk Area

A major proportion of existing potential shelter space and the greatest concentration of population are located within likely target areas. However, the very significant remaining balance of shelter spaces in the other areas of risk, totals some 14.9 million spaces and represents a valuable non-military defence inventory resource.

Political Division \ Agency	1	2	3	4	5	6	7
Newfoundland	38246	204961	2595	46548	37491	920	166118
New Brunswick	72693	75287	56972	219785	172321	9694	433017
Prince Edward Island	7918	26503	922	21683	20391	582	36317
Nova Scotia	74641	89016	92616	102313	99652	7841	367106
Québec	530946	1108882	579576	2943376	2772200	123738	10566341
Ontario	1201260	799434	944750	2921578	1097672	86080	15277795
Manitoba	135723	165023	142561	223707	99827	12255	1608261
Saskatchewan	130639	171857	107826	252663	90995	23468	612719
Alberta	119262	450634	190391	243701	116168	28230	1151135
British Columbia	239907	313484	260847	358089	106291	52831	2539281
Total	2551235	3405081	2379056	7333443	4613008	345639	33158090

Agency refers to the ownership categories which are as follows;

	Agency Code		Agency Code
Federal	1	Religious Organizations	5
Provincial	2	Public Utility Undertakings	6
Municipal	3	All Others	7
School, Collegiate & Other Boards	4		

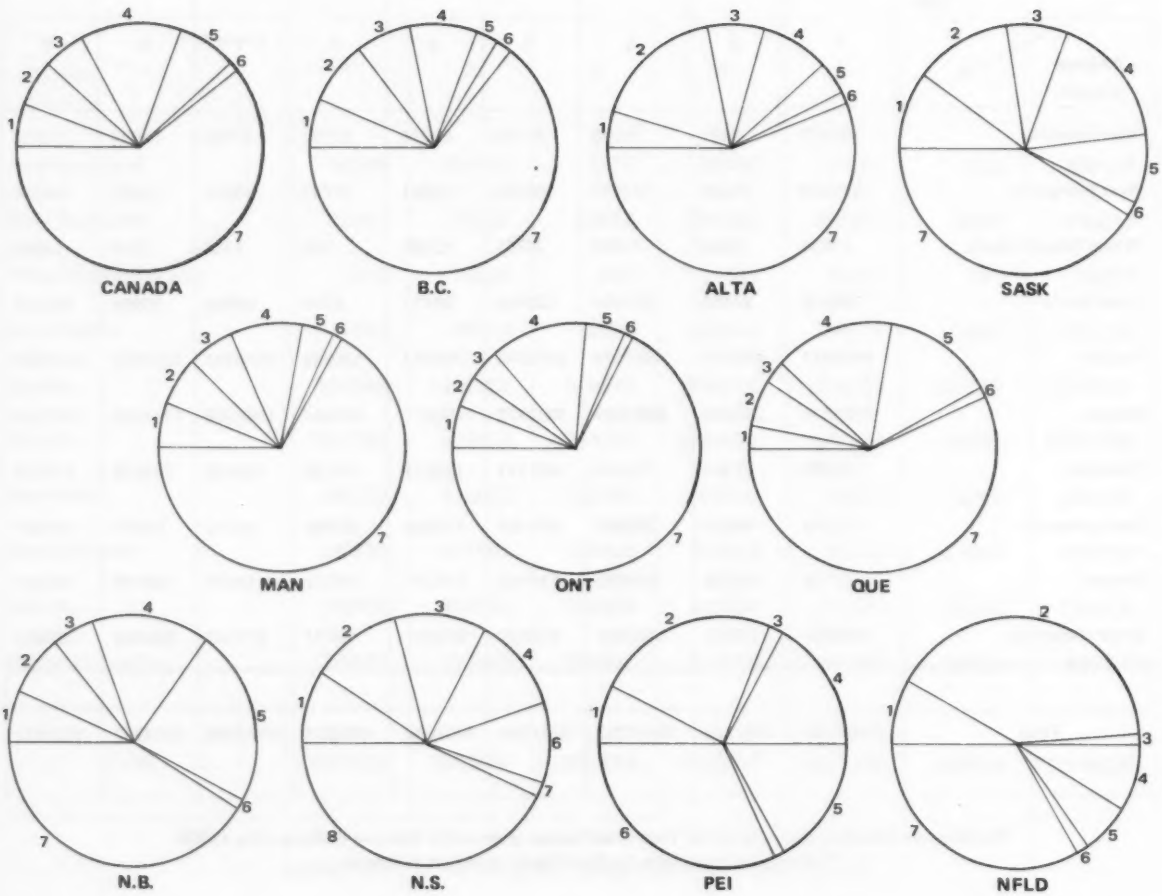
Figure 9. Summary—Potential Fallout Shelter Spaces by Province and Agency.

Political Division \ Type	1	2	3	4	5	6	7	8	9
Newfoundland	151772	9891	70986	42183	49074	12109	47894	29914	83056
New Brunswick	317482	27670	122774	164332	115991	42747	90450	53989	104334
Prince Edward Island	37004	3643	17292	20781	13189	345	7306	3210	11546
Nova Scotia	158652	27460	201244	126424	89421	8276	62850	26996	131862
Québec	4409841	438709	4861574	2346043	780543	435852	1930441	1937461	1484595
Ontario	3724319	338950	8847657	3091872	1408471	919040	1584666	1111404	1302190
Manitoba	328096	37397	715012	497121	133827	96120	155435	249629	174720
Saskatchewan	307989	48057	255507	291159	118696	63789	89773	83570	131627
Alberta	472143	185058	619056	716406	170221	69828	114074	193128	159607
British Columbia	590887	70283	1106101	745527	283071	48771	321109	365096	339885
Total	10498185	1187118	16817203	8041848	3162504	1696877	4403998	4054397	3923422

Buildings are classified according to the Type Classification given in the National Building Code (1965).
The assigned type codes for the different types are as follows:

Assembly	1	Commercial and Industrial	
Institutional	2	Division 1	6
Residential	3	Division 2	7
Business and Personal	4	Division 3	8
Mercantile	5	Hospitals and Nursing Homes	9

Figure 10. Summary—Potential Fall out Shelter Spaces
by Province and Type.



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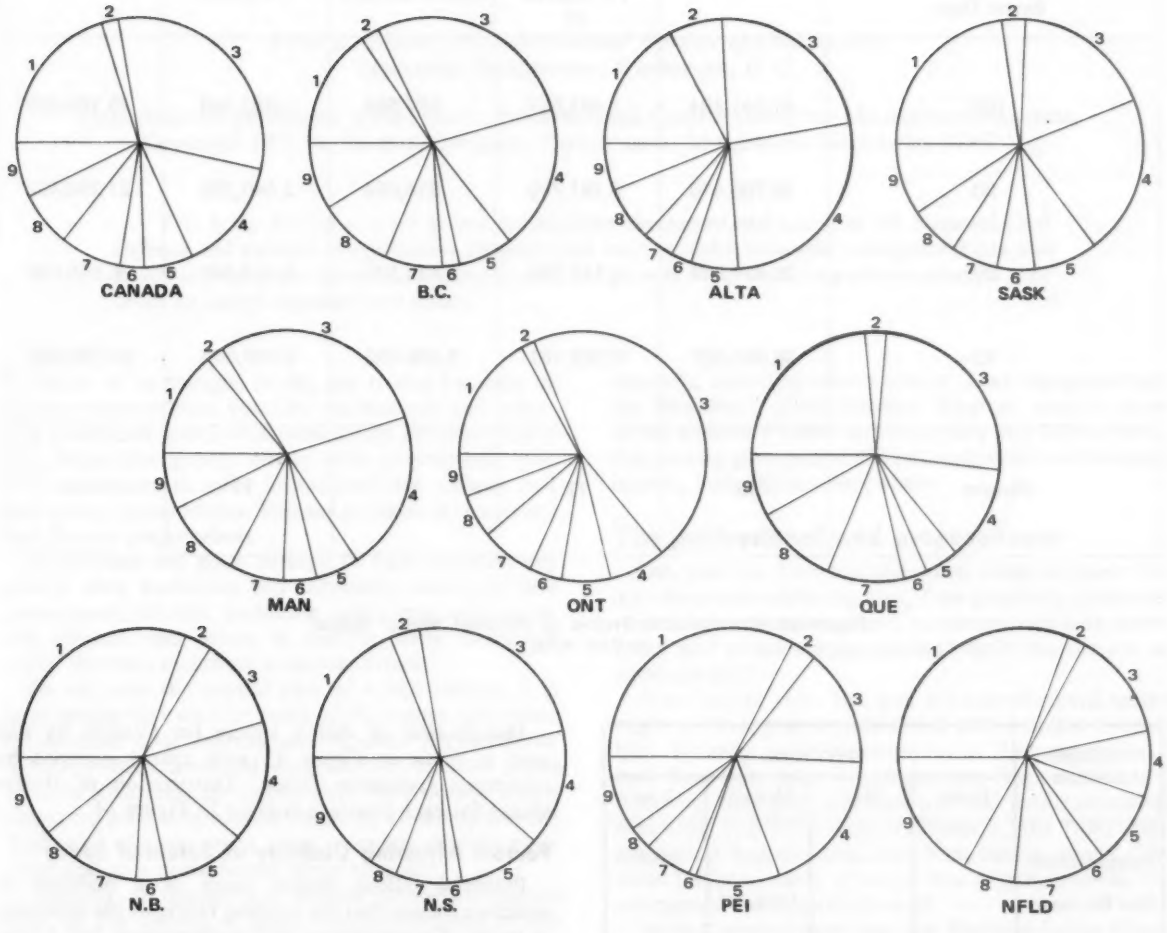
Municipal	3	All others	7
School, Collegiate & Other Boards	4		

Figure 11. Distribution of Shelter Spaces by Agency.



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Assembly	1
Institutional	2
Residential	3
Business and Personal	4
Mercantile	5
Commercial and Industrial	
Division 1	6
Division 2	7
Division 3	8
Hospitals and Nursing Homes	9

Figure 12. Distribution of Shelter Spaces by Type.

Protection Factor Equal to or Better Than	Direct	High (>5400R)	Medium (820R–5400R)	Low (<820R)	Total
100	11,241,184	1,491,927	567,689	1,883,899	15,184,699
50	15,705,410	2,191,795	818,854	2,540,398	21,256,457
20	26,877,964	4,117,324	1,435,105	4,124,647	36,555,040
10	38,847,027	6,522,181	2,406,450	6,009,894	53,785,552
Percent	72	12	5	11	100

Figure 13. Canada—Distribution of Potential Shelter Spaces by Risk Area.

Political Division	Risk Areas			
	Direct	High	Medium	Low
Newfoundland	—	—	—	496,879
New Brunswick	—	—	1,039,769	—
Prince Edward Island	—	—	114,316	—
Nova Scotia	585,436	700	179,056	67,993
Québec	13,850,133	2,867,169	397,272	1,510,496
Ontario	17,149,689	3,464,376	565,598	1,148,906
Manitoba	2,094,260	57,654	13,050	222,393
Saskatchewan	—	—	—	1,390,167
Alberta	2,309,663	35,607	92,054	262,197
British Columbia	2,857,857	96,675	5,335	910,863
Canada	38,847,027	6,522,181	2,406,450	6,009,894

Figure 14—Provinces—Distribution of Shelter Spaces by Risk Area.

Distribution of shelter spaces for Canada by risk area is given in Figure 13 with spaces grouped by minimum protection factor. Distribution of shelter spaces for each province is given in Figure 14.

Factors Affecting Usability of Potential Space

Potential fallout shelter space in a building or structure means that the existing fabric of the building, in terms of construction and configuration, has a protective shielding capability against the effect of nuclear radiation, or to be specific, gamma radiation as a result of fallout. Usable fallout shelter space is that inherently shielded portion of a building or structure which is habitable, has sufficient ventilation and is of adequate size.

Some of the adverse factors likely to affect the usability and hence reduce the number of available shelter spaces, include:

- availability of building
- fixed or heavy equipment
- ventilation
- protection factor requirements
- relative location

The data pertaining to potential fallout shelter spaces were derived from the shelter area figures given in the final results of the Fallout Protection Survey of Canada, on the basis of 12 square feet per shelter space.

(*Continued on page 17*) **FALLOUT**

INDUSTRY'S ROLE IN THE NATIONAL CIVIL DEFENSE PROGRAM

by
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(Industrial Participation) Washington, D. C.

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This is the first of a series of articles outlining the nature and extent of the National Civil Defense and Disaster Preparedness Program and ways in which industrial management can join in partnership in this effort. Succeeding articles will provide comprehensive guidance on steps to be taken by safety engineers and others.

To those of us engaged in the day-to-day business of disaster preparedness, you who are business and industrial executives and professional safety engineers are a very important group. Along with government, you have an important stake in national civil defense and emergency preparedness. You are *partners in emergency and disaster preparedness.*

It has been my good fortune to have worked very closely with numerous top corporate executives and government officials, including safety engineers, security officials, and others in making plans to survive major disaster, including a nuclear attack.

As we enter the second year of a new decade, it is appropriate that we take stock of the nature and extent of national civil defense and disaster preparedness. What has been done and what are the plans for doing more to limit damage, or minimize the effects of major industrial accidents, natural disasters, or enemy attack? And what can *you* do as a top executive of your company and as a professional safety engineer?

Actually, all disaster and defense planners recognize that, in the history of great accomplishments in this nation, very little has ever been accomplished by government alone. Instead, the cooperation, support, and assistance of business and industrial leaders and professional safety experts have been necessary. In fact, Federal, state, county, and city governments throughout the nation have recognized the importance of business and industrial *partnership with government* in making plans to limit damage, or minimize the effects of major disasters, including enemy attack. They recognize that the President's Civil Defense Program cannot move ahead without a better understanding and full cooperation among government officials, industrial and business leaders, and citizens everywhere.

**ABOUT THE AUTHOR*

Virgil L. Couch, as Assistant National Director of Civil Defense and, more recently, as National Director of Liaison Services for the Agency, is the nation's top advisor to business and industry on methods of preparing to survive major disaster. For almost 40 years he has supervised emergency and disaster preparedness activities in both industry and government. Few men in the United States today can match his experience, background and knowledge in this field.

The professional and preparedness

But, you say, I am a professional safety engineer. As a professional safety engineer, I am primarily interested in accident prevention. Am I concerned also with emergency and disaster preparedness? Isn't this the job of someone else?

But, I say to you: Yes, you are a professional safety engineer. Yes, you are concerned with accident prevention. Actually, accident prevention is "loss prevention," and "loss prevention" includes loss from accidents—loss from both personal accidents and major industrial accidents, loss from natural disasters, loss from environmental hygiene, and loss from enemy attack. The basis for prevention of major loss is preparedness for emergency and disaster control.

In fact, several years ago, the National Safety Council—of which many of you are members, and which publishes the very comprehensive *Accident Prevention Manual*, which is the "bible" for professional safety workers—included a chapter on emergency and disaster preparedness in the manual. This chapter has been continuously revised and updated, and has recently been rewritten by a special advisory committee to the National Safety Council, to include more emphasis and enlarged subject matter on civil defense and emergency preparedness.

Therefore, you who are professional safety engineers represent one of the greatest forces for preparedness in this country. You are representatives of American industry, institutions and governments. You are *partners* in emergency and disaster preparedness.

Emergency and disaster hazards

Let's look at some of the threats to the security and well-being of the individual American today. These

hazards fall into several major categories.

The first is the threat from major industrial accidents involving explosions, fires, and collapsing buildings due to construction defects.

The second is the age-old threat from nature-on-the-rampage: natural disasters, including tornadoes, hurricanes, floods, earthquakes, and volcanic eruptions.

The third (a comparatively new hazard) is environmental deterioration. The deterioration of our environment, through pollution of air and water and the waste of other natural resources, affects nearly every American and threatens our future.

Fourth: Another threat new in the past decade includes civil violence. Some members of our society—and fortunately they are few—have chosen to show social protest by acts of arson, bombing, shooting, and riots.

Fifth is the new danger involving blackmail by bomb threats. Some companies are receiving phone calls at the rate of over 1,000 per month from anonymous callers, telling that a bomb has been placed in their plant, office building, bank, or institution, set to explode in a short time.

Sixth is the military threat. It is not my purpose to scare anyone, but I believe all Americans should look closely at a military threat facing our nation. Let me describe some of the major elements of this threat rather briefly.

- In the last three years the Soviet Union has more than quadrupled its land-based missile forces—its ICBM's. Today Russia has more ICBM's than the United States, and the rate of production of missiles is increasing.

- All indications are that the Soviets are expanding their submarine-launched ballistic missile forces. They have the capacity to equal our own forces, in terms of numbers, by 1975.

- Evidence indicates that the Soviet missile forces may have twice the weight-carrying capability—or nuclear payload—of our own missile forces . . . Air Force Secretary Robert Seamans described it in testimony before a Senate committee.

While the *likelihood* of enemy attack is small, the *threat* is large. More and more nations have or will have the capabilities to manufacture and deliver nuclear weapons.

During the past several years, the Department of Defense has conducted intensive studies on the effects of various hypothetical large-scale nuclear attacks against the United States. These studies are continuing on a day-to-day basis. I hasten to remind you that the effects of blast and heat in all-out nuclear attack upon our nation would cover *less than ten percent* of the total geographic area of the U.S.; the effects from fallout, under varying sizes of attack and wind conditions, could cover the other *90 percent* or more.

People living in areas not effected by blast and heat could be killed or injured by radioactive fallout, a major *environmental* hazard. Fall-out protection is provided by fallout shelters. Fallout shelters, therefore, have the highest priority and are the key element in the National Civil Defense Program.

There is no doubt about it in the minds of defense leaders: The threat exists and it is growing. Many people don't like to think about it. But our job—yours and mine—is to think about it, and to prepare. There is much we can do together to prepare. This brings me to the subject of civil defense—a *people-protection* program, the only program of its kind in our entire structure of national defense.

Who is responsible for protection?

More and more Americans today are calling upon government for protection against these threats—old and new threats, peacetime and wartime threats. In fact, their demands are directed to all responsible elements of our society and especially to industry.

We in Civil Defense, because of our close working relationship with industry and professional safety and security officials over the years, know perhaps better than the general public that business leaders and professional workers are responding to these demands, and that progress toward emergency and disaster preparedness and a cleaner environment is already being made through your efforts.

On the part of government, we recognize that we at the Federal level must exercise vigorous leadership and provide national-level guidance and direction. But this fact is also clear: While vigorous leadership is required at the state and national level, the most effective *actions* by far will come at the local level of government, and in the private sector of the economy.

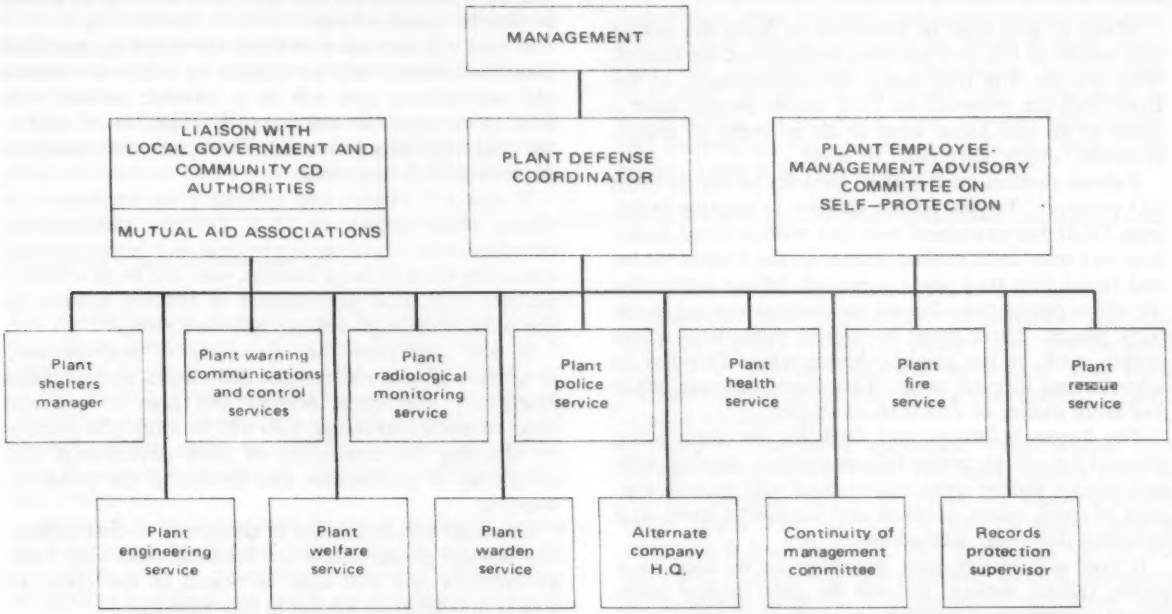
Public protection must be "full coverage" protection, and it can be assured only by the full mobilization and use of all of the protective resources of the community. Furthermore, when we talk about plans and actions to protect people from avoidable hazards, we're really talking about a *local civil defense system.*

Today, about 4,500 local governments in the United States, with jurisdiction over some 90 percent of our population, now have civil defense systems of some kind. In this fact lies the potential for tremendously effective action, on a nation-wide scale, to attack our newer problems in public safety and cope more effectively with the older threats to life and property.

This potential has led us in OCD to change the thrust of the national effort.

A change in emphasis

Since 1961, our primary objective in OCD has been to help communities establish shelter, attack-warning, and radiological monitoring systems for a nuclear emergency. Now, we believe the time has come to strengthen the other local operational capabilities which support both the wartime and peacetime goals of civil defense. We are asking our partners in industry and business to make this same change in emphasis.



Our course, your primary responsibility must be directed toward the safety and well-being of people in your own organization. But your help is now vitally needed also to create more effective community-wide systems of protection against all hazards.

With your cooperation, we can create a new and modern public image for civil defense. We can dispel the notion that civil defense is the responsibility of one person—the civil defense director.

The elected officials of each community bear the ultimate responsibility for the safety of the citizens, but *all of us* must help them meet this responsibility. As I mentioned earlier: *Civil defense must provide for the total involvement of community resources to meet an emergency.*

We have come to realize at the Federal level that there is very little difference between preparedness for nuclear attack and preparedness for other large-scale emergencies. The community that is prepared to cope with a Hurricane Camille, or an Alaskan Earthquake, or an extensive flood, will have the organization and many of the skills to cope with an attack emergency. Fallout shelters and radiological defense capabilities would be necessary additions.

What is civil defense?

Perhaps we should consider for a moment just what is this thing called Civil Defense that threatens to invade the very fabric of our political, industrial and private lives. What are we talking about?

An erroneous impression has been established in the minds of many that Civil Defense is an organization separate from local government, and that we would confront a major disaster, regardless of cause, with a group of fully trained *volunteers*. Nothing could be further from the truth. Civil Defense is not a kind of volunteer-staffed second government which is superimposed upon existing government with the help of safety and security officials, professional and technical personnel.

Actually, when we use the words "Civil Defense" we are simply talking about *civil government in action in time of emergency or major disaster*—together with the help of citizens and with the help of business and industrial firms and institutions working together to minimize the effects of disaster—to save lives and protect property, to limit damage from the disaster.

Who is the CD program?

When we talk about the national Civil Defense program, we are talking about a warning system, a communications system, a radio-logical detection plan. We are talking about training and education activities, so people will know where to go and what to do in event of emergency or disaster. We are talking about cooperation of all departments of local government in developing community-wide fallout shelter plans to protect people, and other activities to protect property.

Who is responsible for civil defense? The elected heads of government—the President, the governor, the mayor and the county commissioner, each in his own area of jurisdiction. The Civil Defense directors and their staffs serve the governor, the mayor, the county commissioner in a *staff capacity*. It is the elected official who has the *command responsibility*.

Keep this in mind when making Civil Defense plans in your companies, and be sure to make company plans in close cooperation with your local government.

More fallout shelters needed

Many of you may be surprised to learn the nature and extent of CD preparedness throughout the nation. Now for the first time since the establishment of the Civil Defense program in 1951, many people have a place to go and know what to do in event of attack. However, much more must be done.

Fallout shelters have highest priority in the national CD program. To *find* fallout shelters in existing buildings, OCD has examined over five million large buildings and over eight million homes in the United States and found that they contain enough fallout shelter for the entire population. But all the shelters are not in the right places. There must be fallout protection where people work, in the neighborhoods where they live in schools, and in rural areas. Therefore, we must either *find* more shelter or *create* more shelter.

The larger buildings and facilities are now being licensed for use as public fallout shelters, marked with appropriate shelter signs and stocked with austere supplies of food, water, medical and sanitation items and radiation detection instruments.

If you will permit your buildings to be used as a public fallout shelter, we will be able to *find* more fallout protection. I hasten to say "thanks" to those of you who have so generously cooperated by licensing your office buildings, refineries, plants, warehouses, and other facilities for use as public fallout shelter—you are *partners* in defense preparedness.

If you will include fallout protection in the initial design of your new buildings and other facilities, you will be able to help us *create* more shelter. By use of our modern low-cost shelter design techniques, you will be able to provide shelter for more people in your new buildings, at little or no additional cost. Architectural and engineering guidance is available to you through Civil Defense offices.

After public shelter is located, marked and stocked in a community, the next big job is to develop plans for assigning residents of specific areas to specific shelters, including procedures to get them to shelters—*community shelter planning*.

What industry can do

The excellent progress in CD and disaster preparedness that has been made to date has been due in large measure to the excellent cooperation, assistance and support of American industry. *In partnership with local government*, you in business and in industry can do much to help local government achieve its objectives in community Civil Defense preparedness.

If you will permit your office buildings and plants to be used as public fallout shelters, you will be making a major contribution to saving lives in event of attack. You will be a good partner in Civil Defense.

If you will expand your emergency plan by organizing and training groups of your employees in warden and police duties, firefighting, rescue, medical self-help, radiological monitoring, and shelter management, you will be a valuable partner with your local government in disaster preparedness.

If you will arrange to receive the warning, establish communications, and participate in industrial mutual aid associations, you will be a valuable partner with local government in achieving its objective of organizational capability to manage in wartime emergency as in peace-time emergencies.

If you will inform and educate your employees by giving them copies of Civil Defense publications, enrolling them in classes in personal and family survival and other Civil Defense courses, you will be an effective partner with local government in helping achieve its objective of an informed and educated public.

If you will plan for continuity of management, protection of vital records and documents, and establish emergency operations centers and plan to preserve your corporate structure, you will be a forceful partner in planning for continuity of civil government and continuity of production and service to the public in wartime.

Guidance and assistance in all aspects of civil defense and disaster preparedness are available from your local government and will also be found in the series of articles scheduled to appear in this magazine.

CD pays off in peacetime

More and more companies are reporting that Civil Defense preparedness is paying great dividends by saving lives and protecting property in *peacetime disasters*, such as fires, explosions, floods, hurricanes, tornadoes, falling aircraft, transportation accidents and the more recent unfortunate occurrences—riots and civil disturbances.

The experience we gain in dealing with peacetime emergencies is helpful to both government officials and industrial executives as training for Civil Defense in the ultimate disaster, the worst emergency—enemy attack with thermonuclear weapons.

The value of such experience was brought home to us forcefully when we visited Mississippi right after Hurricane Camille smashed many communities. Mile after mile of homes and business establishments had been swept clean to the ground by wind and the 22-foot tidal surge. Not even scrap lumber was left, only a few foundation stones. Government itself had been seriously damaged or completely destroyed in many communities.

And yet, when we talked with people in the area, we found that business and community leaders had stepped in to fill the void created by loss of government leadership. We found that business and industrial establishments, not only nearby but in areas far removed from the hurricane area, were donating food, clothing, building materials, tools, equipment, machinery, transportation and other needs for restoring the normal way of life.

The interest and concern of private industry in preparing for Civil Defense is continuing at a high level. Many companies have not only prepared for

their own survival, but are giving support and assistance to local government in achieving their major objectives in preparing for survival of the entire community. They are partners with government in national defense preparedness.

This entire Civil Defense program has one paramount mission: Help the people. We call it a *people-protection program* because that's just what it is. This particular defense program is, by law, managed through a joint partnership of the Federal, state, and local governments. It is the only defense program for which Federal, state, and local governments are responsible. Government alone can't do the job. We need your partnership in preparedness. Government can provide information and leadership, but initiative in CD and emergency preparedness is in your hands.▲

(**FALLOUT** *Continued from page 12*)

The usable spaces however, will be considerably less than these because of the factors listed above. It is important to emphasize here that the main purpose of the Fallout Protection Survey of Canada was to identify *potential* shelter space. Determination of the usability of this space was not included in the project, even though information on usable areas of basements was recorded.

Although a building could be made available during an emergency by special legislation, it may not be feasible to plan in peacetime for its use. Many areas of existing buildings are taken up with fixed or heavy equipment which would effectively prevent use of this space and since the ground floors and upper storey areas indicated in the survey results, are based on gross floor areas, there is likely to be a significant reduction in numbers. Ventilation requirements of a shelter space may not be adequate for maximum space utilization, although this is likely to be less of a problem for upper storeys than for basement and sub-basement areas. Protection factors may not be good enough to provide adequate protection and some potential shelter areas may not be conveniently located to plan on their use.

There is one other important consideration that should be mentioned here. The **Area Factors** used in the computation of shelter areas are conservative in many cases. For example, if the dominant gamma radiation is from the roof, then protection factors will generally be greater at the perimeter than at the centre of a shelter area. It is quite likely, therefore, that additional spaces could be found by further careful examination of each shelter area.

A realistic estimate of usable shelter space would be of the order of 60 percent of the total surveyed potential spaces. This represents a significantly valuable life-saving capability—if plans are developed in peacetime for use of those spaces in a war emergency.▲

PARISH WAR EMERGENCY PLAN

by

Brigadier T. E. H. Helby, M.C. (Retired)

These notes follow the author's paper "Survival" published on the Digest, Vol. 10, No. 4, August-September, 1970. They were prepared as guide to problems in the United Kingdom in the preparation of war emergency plans for rural parish councils and not intended as a model for an outline plan.*

Introduction

During the course of a war emergency conditions in the Parish are likely steadily to deteriorate.

At first, perhaps for a short time only, the normal routine of rural life may go on, but on the declaration by the Government of an emergency, the 'War Emergency Control Organisation' will be established, and very soon various war emergency measures, such as the evacuation of certain people from urban areas, food rationing, restrictions on the use of petrol and motor vehicles, etc., will be decreased.

The 'War Emergency Control Organisation' provides for a District Controller (usually the Clerk to the Rural District Council) in each rural district, to be responsible for the administration of the area during the emergency.

Mounting pressure on the rural areas to accommodate people from the towns, scarcity of essentials, and the increasing difficulty of communications will lead to greater responsibility for the administration of the area being laid on the parish authority, possibly even before the declaration of an emergency.

As the intensity of hostilities increases, the devastation caused by the attacks and the consequent disruption of much of the fabric of society, together with inevitable shortages of food, oil fuel and electrical energy, as well as further deterioration in the systems of transportation and communication may force us to make radical alterations in our system of government in order to avoid a complete breakdown of the administration.

It may well be that prevailing conditions will, for an appreciable time, make it difficult, if not impossible, for the District Controller, especially in a large rural area, to fulfil his statutory obligations.

For a very considerable time the parish may find itself isolated and entirely responsible for its own administration, virtually on its own, with its population swollen by refugees, dwelling accommodation quite inadequate to meet requirements, shelters giving protection against radiation from fall-out few and far between, resources of food and transport scanty in the extreme, starvation and disease becoming familiar conditions, security of life and property, especially of stocks of food, precarious, and the maintenance of law and order only as effective as the parish of its own resources can make it.

*Roughly equivalent to county or township.

A heavy responsibility for the survival of the parish community will rest on the Parish Authority; and, if that responsibility is to be discharged effectively, thought must be given, while yet there is time, to the various problems with which the parish authority is likely to be faced.

Now is the time for these problems to be examined; and now is the time for the Parish Council to initiate the preparation of a plan to enable the life of the parish community to continue during the course of the emergency.

A Parish War Emergency Plan

Without waiting for the development of an emergency, the parish council should appoint a committee of suitable persons to study the problems involved, and to formulate an outline plan for the administration of the parish during a war emergency.

Since years may elapse between the making of a plan and its implementation, it will not usually be useful to nominate individuals for various appointments which will be required, but it may be appropriate to earmark certain buildings for specific purposes.

The plan should cover the following matters:—

- The organisation and control of the parish.
- Refugees.
- Billeting and accommodation.
- Welfare and Information Services.
- Food procurement, distribution and feeding.
- Water supply.
- Fuel supply.
- Transport.
- Hygiene and sanitation.
- Medical.
- Burial of the dead.
- Protection against radiation from fall-out.
- Food production.
- Law and order.
- Use of man power.

Organisation and Control of the Parish

The Parish Executive

Throughout the emergency the parish will need a body to give leadership and direction to the affairs of the community.

A small executive committee capable of forming sound judgments, making quick decisions, issuing and

enforcing clear and firm orders, with wide powers to regulate the affairs of the parish would best meet this need.

The parish council must be prepared to appoint such a 'Parish Executive' when needed, and in the absence of instructions from above, to assume the responsibility of conferring on it authority to issue such orders and take such action as may in the opinion of the Executive be necessary for the safety and orderly administration of the parish.

A team of three or four persons would be suitable as a Parish Executive. It would be an advantage if at least one member had received some training in Civil Defence and another had a knowledge of farming and food production; but the qualities chiefly required are leadership and administrative ability.

A suggested allocation of responsibilities between the different members of a four man Parish Executive is given below:—

Leader
Overall responsibility and co-ordination.
Communications.
Man power and direction of labour.
Law and order.

Second Member
Allocation of accommodation.
Provision of shelters.
Repair of damaged buildings.
Refugees.
Billeting.
Welfare.
Information services.
Medical.
Hygiene and sanitation.
Burial of the dead.

Third Member
Rationing.
Communal feeding.
Water supply.
Fuel supply.
Transport.

Fourth Member
Procurement of food.
Farm food production.
Garden food production.
Fishing.
Storage and bulk issue of food.

To be able to deal expeditiously with the numerous and varied problems which will demand attention, each member of the Parish Executive will need under him one or more assistants, some of whom may be technical, as well as messengers for communication within the parish. A suitable building or shelter to house the Headquarters of the Parish Executive will also be required.

Parish Organisation

The survival of the parish community will depend on its members giving of their best in hard continuous work with little thought for self, working as a team effectively directed to carry out those tasks essential for its life. It is the prime duty of the Parish Executive to give the inspiration and the wise and effective direction which will result in this being done.

The parish must therefore be so organised that the ideas and instructions of the Parish Executive can be disseminated quickly throughout the community, without the Parish Executive having to deal directly with more than a limited number of subordinates.

The organisation of the parish on a geographical basis would probably be appropriate, the parish being divided into areas of suitable size and population. Each area would be under a leader directly subordinate to the Parish Executive. It might be desirable further to subdivide certain areas, the subdivisions being under subordinate leaders responsible to the appropriate area leader. It might also be advantageous for each outlying farm to constitute a separate area.

Intercommunications

Whilst during the warning period normal means of intercommunication are likely to be available, and warnings and information will be disseminated by broadcast; after the declaration of a war emergency, the parish will find itself with no internal telephone communications; only one or two telephones in the parish will be available for making calls. The remaining telephones, so long as they are working, will be able to receive, but not make, calls.

After the outbreak of hostilities, communication with the District Controller, or any authority outside the parish is likely to be precarious.

For internal communications within the parish messengers, if possible with bicycles, will be required.

Refugees

Whatever the true facts may be, the South West corner of England is likely to be regarded as an area of comparative safety and one in which there is an abundance of home grown food. It is thus an attractive area to which migrants from the cities will certainly make their way, and one to which evacuees from the industrial areas will be sent.

If warning of possible attack extends to days rather than hours, the population of the parish is likely to increase to such an extent that, for some people, a few square feet under any roof is all the accommodation that will be available, while accommodation in shelters giving protection against radiation will clearly be quite inadequate.

A parish rest centre for the reception of refugees, their documentation and billeting in the parish, or onward transmission to another area will be required, and should be established during the warning period.

Billeting and Accommodation

The Parish War Emergency Plan should include a report of a survey of accommodation in the parish showing:—

- Accommodation suitable as billets.
- Accommodation not amounting to billets but providing protection against the weather.
- Accommodation which affords, or with moderate effort could be made to afford, reasonable protection against radiation.

A Parish Billeting Officer with one or more assistants as well as a number of guides will be required to list the refugees, allot them to billets and guide them thereto.

Remember to billet urban refugees in the main village and rural refugees in the outlying farms.

Welfare and Information Services

It will be of great benefit to the morale of the parish if there is someone to whom the homeless and others can turn for help, and for information, particularly as to the whereabouts of lost children and relatives.

A Parish Welfare Officer should work in close co-operation with the Billeting Officer. In addition to organizing help and succour for the homeless, he could conveniently be made responsible for the documentation of refugees, keeping a record of all people living in the parish, and for keeping the daily total of the parish's ration strength.

Food Procurement and Distribution

During the warning period householders should endeavour to build up a stock of food in the home. They should remember that because of possible danger of radiation from fall-out they may have to spend some days in shelter and be unable to get out to get further supplies.

They should also remember that the household with whom the available food will have to be shared may be several times larger than the normal household, although some of the refugees may bring a few days' food with them.

At an early stage the issue to parishes of food in bulk from emergency stocks held for the purpose, and the institution of food rationing, may be expected.

It is not known how rationing would be carried out; but it is clear that it will have to operate at parish level, and the Parish Executive must ensure that it works smoothly.

After the commencement of hostilities, when the initial attacks have ceased and radiation from fall-out has decreased to a degree which will allow of the resumption of movement in the open, the situation may be very different.

The parish may well find itself out of touch with any superior administrative authority, with no electricity supply, possibly no piped water, hardly any transport or means of inter-communication, little fuel, the rationing system breaking down, and, except on the farms, no food.

At the same time hungry people will be looking for food, and they may not be very particular as to how they get it.

In the circumstances it will be the duty of the Parish Executive to procure and distribute fairly the food the people must have. A communal feeding centre, organised to produce one meal a day for every person in the parish might best serve the purpose. The Parish Executive will have to secure for the public use, and safeguard, whatever stocks of food may already be stored in the parish, or subsquently be delivered thereto.

They must remember that as food becomes increasingly scarce, marauding bands of hungry people, probably armed, will be liable to appear wherever there is food to be had, and neither police nor troops will be available to protect every outlying farm.

How can stocks of food and livestock on farms outside the main village best be protected? Would it be better to concentrate the stock of food in a properly guarded parish store, and risk losing the lot should the guard be overpowered, or leave supplies dispersed and not very adequately guarded on the farms? And should the surviving livestock be concentrated on one or two farms, or should they be left widely dispersed?

The Parish Executive must also remember that the parish may have to surrender, for use in the towns, a proportion of the stocks of food on its farms; and they must never forget that to allow the seed corn or breeding animals to be taken away, or consumed, will surely lead to famine.

The Parish War Emergency Plan should cover the following matters:—

- The operation in the parish of a national rationing scheme, if one is instituted.
- In the event of a national rationing scheme not having been instituted, or breaking down, the organisation of a system for making equitable distribution of available food to all persons living in the parish.
- The establishment of a communal feeding centre complete with the necessary personnel and equipment. This should be established early in the emergency, even if it is not required for immediate use.
- Arrangements for the supply of fuel and water for the communal feeding centre.
- Storage and safe custody of stocks of food in the parish.
- The method of feeding the outlying farms and hamlets whose people cannot easily attend the communal feeding centre.

Water Supply

The water in our streams, rivers and reservoirs does not itself become radio-active as the result of a nuclear explosion in its vicinity; but fall-out may come down throughout the catchment area of the rivers and reservoirs. Radio-active particles of dust may fall on, or

be washed into, the water where they will float on top, or be held in suspension in it. Thus, unless by distillation or filtration, the radio-active dust is removed, the water itself must be treated as if it were radio-active.

In the course of time, if no further fall-out arrives in the area, streams and rivers will clear themselves, and reservoirs can be emptied and allowed to refill with uncontaminated water. For how long the water supply will remain contaminated cannot readily be estimated, as it will depend on the degree of contamination, the duration of exposure thereto, and the weather conditions at the time.

Thus, after the arrival of fall-out from a nuclear explosion, which may have been a long way from the catchment areas, the only water safe for human or animal consumption may be water stored in covered containers, water from covered reservoirs which are not being supplied from a contaminated source, and water from wells.

It must be remembered too that a nuclear attack may so damage the water supply system that no piped water may be available.

During the warning period as much pure water as possible must be stored in the home in suitable covered containers, and elsewhere in tanks and reservoirs which can be covered and properly protected against contamination. Covered reservoirs forming part of the normal water supply system, should, before the arrival of fall-out, be isolated from any source which might become contaminated.

When radio-activity has decreased to a degree which will allow for movement in the open again, much of the pure water previously stored will have been used up, and it is likely that we shall have to rely on water from wells for human and animal drinking. It may therefore be necessary to control its use, possibly reserving it for drinking and cooking only, or even to ration it.

Before there is any threat of an emergency, the parish council should arrange for information about sources of water supply in the parish which are likely to remain uncontaminated to be obtained and recorded.

The Parish War Emergency Plan should cover the following matters:—

- The location, control and safeguarding of sources of water likely to be uncontaminated.
- The supply of uncontaminated water for drinking and cooking and a system of water rationing should this become necessary.
- The provision of equipment for drawing water from wells—buckets, ropes, hand pumps, etc., as may be appropriate for the wells available.
- Arrangements for the transportation of water to, and its storage at, the parish communal feeding centre.
- The chlorination of drinking water insofar as this is practicable.
- A map showing the location of reservoirs, mains and stopcocks within the parish.

Fuel Supply

During the warning period households would do well to build up a stock of fuel. The parish authority should do likewise so that, while motor transport is still available, they may accumulate a stock of fuel for use by the communal feeding centre when it has to be taken into use.

Once a state of emergency has been declared it is probable that all available oil fuel will be reserved for the operation of essential transport and for agricultural production; and after the commencement of hostilities, there may be no electricity or gas for cooking, or space heating,

It is possible that at an early stage the Government may organise the supply of solid fuel to parishes from emergency stocks held for the purpose, but this cannot be relied on.

It seems unlikely that after the commencement of hostilities any significant quantity of solid fuel will be brought into the parish from elsewhere. When initial stocks of fuel have been used up the parish will be dependent on local woods and trees.

The use of fuel for cooking will be essential, and possibly some space heating will have to be done; nevertheless, it is very desirable that the fuel supply should be eked out to the end of the emergency without the countryside having been completely denuded of its trees.

The parish council should, therefore, consult with the Forestry Commission on the whole question of the use of the woods and trees in the parish for fuel, the order of priority in which the various woods should be used and the extent to which woods should be clear felled, or only thinned.

The communal feeding centre will require a regular supply of fuel; and it will be the duty of the Parish Executive to organise and equip the necessary working parties for its cutting, collection, and transportation.

The outlying farms and hamlets could probably be left to make their own arrangements for collecting fuel. It might be desirable to allot to each farm specified areas for cutting, and possibly to exercise some control over the amount of fuel consumed by them.

The Parish War Emergency Plan should cover the following matters:—

- The laying in of stocks of fuel during the warning period.
- The extraction, collection, transportation and storage of fuel.
- The fuelling of the communal feeding centre.
- The fuelling of other communal centres, such as Parish First Aid Station, for which some heating is essential.
- The fuelling of outlying farms and hamlets.

Transport

At any time when the international situation shows signs of deteriorating, it is a wise precaution to keep

the fuel tanks of vehicles topped up and to have a small reserve supply in cans in the garage.

The keeping of fuel storage tanks on farms full at such a time may ultimately make the difference between the ability of the farm to produce one more or one less harvest at a time when food will be desperately short.

It is probable that during the warning period the Government will requisition a considerable proportion of the available vehicles, particularly load carrying vehicles, to bring the police, fire and ambulance services and the armed forces up to war establishment in vehicles. It is possible that farm tractors and vehicles required for food production would be exempted from requisition.

It is thought that many vehicles, mostly cars, may be brought into the parish by refugees from the cities. As these vehicles will eventually be immobilized for lack of fuel, it is very desirable that before the last drop of petrol in the tank has been used up, the vehicle should be driven to wherever it is to remain. These vehicles should if possible be close parked, out of the way, on land least useful for growing food. They should not be left on the roads.

It is probable that at a very early stage the Ministry of Transport will take over control of stocks of motor fuel, and restrict issues to accredited users for essential services only.

However, during the warning period the parish may still have sufficient vehicles and motor fuel to carry out some of those essential tasks which are more easily done with the help of motor transport.

In formulating the Parish War Emergency Plan consideration should be given to the question of which tasks should be undertaken with the limited amount of motor transport which may be available for only a short time. The collection and storage of food and fuel should surely be given high priority.

In the post-attack period, except for stocks of tractor fuel held on the farms, it seems unlikely that there will be any significant quantity of motor fuel in the parish, and if overseas communications are interrupted, before long the parish may be forced to abandon the use of motor transport entirely.

Any transportation of goods which may then be necessary must be either by human portage or in motor vehicles hauled by man power. Further, when fuel for the tractors on the farms is exhausted, man power will have to supply the energy for working on the farm.

Drag ropes for hauling vehicles, ponies and bicycles for intercommunication will be at a premium.

Hygiene and Sanitation

During the warning period, normal public health facilities will probably be available, except insofar as the large increase in population may overload the toilet faciliies, and refuse collection may cease.

In the immediate post-attack period, the parish may find the sewage system not working for lack of either water or electrical energy for the sewage pumps; carcasses of dead animals lying about in the fields; soap, detergents, antiseptics and sanitary stores and equipment generally in short supply; flies plentiful; and a population, already deficient in natural immunity to disease, weakened by the effects of radiation, undernourishment and overcrowded living conditions; a situation ideal for the spread of epidemic disease.

Here, the essentials for health will be personal cleanliness, purity and cleanliness of food and water, and the immediate disposal of waste matter by burning or burial.

If the sewage system is not working, water closets must not be used, and dirty water from sinks and basins should not be run off into the drains. Earth closets, trench type communal latrines, soak pits for the disposal of dirty water, and an incinerator for dry waste will be required.

The Parish War Emergency Plan should cover the following matters:—

- The construction of earth closets and latrines.
- The construction of incinerators and soak pits.
- Arrangements for the disposal of carcasses of dead animals.

Medical

During the warning period, attendance for medical treatment at a clinic distant from the parish will be difficult and not always possible, while evacuation to a hospital is likely to be a rare occurrence.

In the post-attack period the situation is likely to be even more acute. The medical needs of the people will have to be met locally. A doctor or anyone with nursing experience resident in the parish will be a very welcome bonus; for it is probable that, for the most part, the sick and injured will have to be tended by the womenfolk of their families.

The Parish War Emergency Plan should cover the following matters:—

- The reservation of a building suitable for a clinic and first aid station, and its provision with such equipment and medical stores as may be required and can be obtained.
- The formation of a team of welfare workers to staff the first aid station.

Burial of the Dead

Interment of those who die in the course of an attack, as well as during the period following, when the level of radio-activity is high, may not be possible until radiation has decreased to a level which will permit of movement and work in the open again. Casualties may be numerous, and for the sake of the morale of the parish, burial must be carried out as early as possible.

The work of digging the graves will be heavy; and, at that time, when the shock of the attack has hardly worn off and radiation sickness is taking its toll, the survivors will be in poor shape to undertake this task as well as the many other very urgent tasks requiring attention.

The need for graves can be foreseen, and the work of digging them should be put in hand during the warning period when the working people of the parish are still fit and strong, and have not yet been reduced by casualties.

The Nuclear Attack and Protection Against Radiation

If the community is to avoid heavy casualties from radiation, the people of the parish, and in particular the Parish Authority, ought to be aware of the implications of a nuclear attack.

Sufficient information to meet requirements at parish level is contained in Civil Defence Handbook No. 10 of 1963, "Advising the Householder on Protection against Nuclear Attack". (Obtainable at booksellers and costing but a few pence).

The Parish Council should perhaps obtain and hold a stock of these pamphlets for issue when required; for it is not unlikely that, for fear of spreading alarm and despondency, the broadcasting of information on this subject might be delayed beyond the point at which the knowledge could be usefully applied.

The Parish War Emergency Plan should cover the provision of shelters giving protection against radiation from fall-out; for casualties from radiation will be directly related to the adequacy of these shelters.

In most rural parishes the older houses with their cellars and thick stone walls afford a considerable degree of protection; and in these houses satisfactory shelters could be made without much difficulty. Many of the modern houses, however, particularly bungalows, afford little protection, and to construct satisfactory shelters in or near such houses would often require considerable labour and materials.

In spite of our best endeavours, it is unlikely that we shall have enough shelters to give proper protection to every member of the parish. The Parish Executive will have to decide on priorities for protection; and on how to control the occupation of available shelters, if indeed this can be done at all.

From the point of view of survival, the most valuable members of the community are the young men and women. It is specially important that healthy young women should be given proper protection, because a dose of radiation may permanently affect a woman's ability to breed normal healthy children, whereas the effect of radiation on the male is not necessarily permanent.

Perhaps the best we shall be able to do will be to advocate "Women and Children first" which is an old established tradition of our people, and therefore likely to be accepted. If the oder members of both sexes give place in the shelters to the younger, we might succeed in our aim of preserving the nucleus of a civilized society on which to build for the future. To survive we must preserve our young men to work and our young women to breed.

Food Production

The aim

The survival of the parish community will largely depend on the ability of that community to continue after initial stocks of food have been used up, to produce sufficient food for its needs.

The Parish some months after the attack

To assess the task facing the leaders of the parish we should try to visualise the parochial scene at this time.

The situation, although difficult and a bit precarious, might still be under control. We might reasonably expect to find the seed corn and breeding animals still intact on the farms; bulk issues of food to the parish from Government reserve stocks have now ceased and are not expected to be renewed; the daily ration, which has periodically been reduced as food stocks dwindled, now barely reaches subsistence level, even though the ration strength of the parish is appreciably lower than it was at the peak period, and is steadily decreasing as the tool of radiation sickness, exhaustion and disease mounts; demands for greater help from neighbouring urban areas are becoming more urgent and insistent; raids on the parish food store, and on the farms, by gangs of hungry people are becoming more frequent and increasingly determined; the period during which it will be possible to continue the present ration issue can be counted in days rather than weeks. The parish is now dependent for its food on what it succeeds in producing itself.

Planning

With no war emergency in the offing and in total ignorance of the time of year when an emergency might occur, it is not possible to formulate a "Parish War Emergency Plan for Food Production".

There are, however, certain matters which, in a war emergency, will call for action on the part of the Parish Executive, and of others. If before any emergency arises these matters have been considered, and possible solutions suggested to some of the problems posed, the Parish Executive may be greatly helped in its very difficult task.

The following are some of the matters which should be considered:—

Animals. The fewer the animal casualties, the longer the food will last.

It should be possible to improvise protection for some of the animals, but remember, a proportion of the outhouses on the farms will probably be needed for human habitation; and consider the problem of feeding and watering the stock while the radiation hazard is still great.

In parishes lying within about twenty miles of an area subjected to nuclear attack, some of the livestock out in the fields are likely to be killed immediately by direct radiation and heat rays, other

animals may die later from the effects of radiation from fall-out. Can this meat be used for human consumption?

In large herds it may be necessary to slaughter some of the cows that cannot be milked. Because of the shortage of time and transport this will almost certainly have to be done on the farm; and unless the carcasses can be skinned, cleaned, dressed and salted much of the meat may be wasted.

A few people in the parish who had previously learned how to do this would be valuable. The improvisation of brine tubs and a stock of salt should not be forgotten.

"The Hungry Gap". Unless there is some food ready to be gathered in our fields and gardens when we have exhausted our initial stocks, we shall go hungry.

If at the first warning of a possible emergency every available piece of land which is at all suitable is sown or planted with anything appropriate to the season which is edible and quick maturing, it is possible that the "Hungry Gap" between the exhaustion of our initial stocks and the harvesting of our home-grown supplies may be eliminated, or at least much reduced.

The Wise Virgins. It is very desirable that by the time we are faced with an emergency the following action should already have been taken on the farms of the parish:—

(a) Fuel tanks and all reserve fuel capacity topped up.
(b) The seeds needed for the next harvest in the hands of the farm and in a protected store.
(c) Stocks of animal feeding stuffs and artificial fertilizer laid in.
(d) A sufficiently adequate supply of the most usually needed spare parts for machinery and implements laid in.
(e) A stock of salt for preserving meat laid in.
(f) A sufficient stock of hand tools accumulated so that the exhaustion of fuel supplies, and the loss of electric power will not result in the process of food production being abruptly halted.

These measures could be put in hand during the period of strained international relations, and before any emergency has actually arisen. The parish authority should do whatever it can to encourage such action.

Loss of Fuel and Power Supplies. It is possible that before an emergency arises this problem will have been considered by the Ministry of Agriculture, Food and Fisheries, the National Farmers' Union and others and advice given to the parish authorities, farmers and others. However, in addition to any general advice which may be received, the matter should be considered at parish level with a view to working out solution appropriate to the particular parish or farm in question.

Land Utilisation. With food as short as it is likely to be, there must be a measure of co-ordination between the farms of the parish to ensure that the available land is used to the best advantage and that a reasonable balance between the production of meat, milk, grain and vegetables is kept. This will have to be worked out by the Parish Executive with the farmers concerned.

There may be farms on which the farmer, his family, and employees have all become casualties. The Parish Executive must arrange for the working of such a farm, for its food potential cannot be abandoned.

Milling. The Parish Authority should give early consideration as to how the grain crop is to be converted locally into flour or meal for human consumption. In some parishes old water mills might be reactivated, in others there may be little alternative to crushing the grain by hand.

Fishing. In maritime parishes the Parish Authority should give early consideration to exploiting the resources of sea and estuary. They should remember that oil fuel may not be available for fishing boats, which will probably have to be worked by sail and oar.

Law and Order

Orderly Conduct in the Parish

During a war emergency involving nuclear attack on this country, heavy initial casualties, followed by widespread loss of life from radiation, exposure, hunger, and disease will disrupt the fabric of our society, and test to the limit the moral fibre of the people.

With fear a too prevalent emotion, and famine and pestilence stalking the land, the temptation to grab for one's self and family the essentials for personal survival, i.e., food and shelter, without regard to the needs of others and often at their expense, may be very great and will not always be resisted.

Yet a community which allows its members to abandon their traditional habits of orderly conduct, keeping the law, and consideration for the needs of others, is in danger of losing its veneer of civilization, reverting to barbarism, and disintegrating. Such a community will have little chance of survival.

In the parish community, any disregard of the law, anti-social behaviour, disorderly conduct, or panic must be checked immediately it occurs. Such conduct is contagious, and, if unchecked in the initial stages, is likely to get worse, and is liable to spread with such rapidity that the restoration of law and order may become a matter of some difficulty. Corrective action must be taken on the spot and at once. The authority so to act, and the means of doing so must therefore be present in the parish.

Responsibility of the Parish Executive

In normal times the responsibility for maintaining law and order rests with the Justices of the Peace,

supported by the higher courts of law for dealing with the more serious offences.

In the chaos of war emergency, access from the rural parish to any court higher than the magistrates sitting in the parish, may be impossible for some considerable time; but, as in the conditions likely to prevail, the trial of persons charged with serious offences cannot safely be delayed, it would seem expedient that one or more Justices of the Peace should be appointed from among the members of the Parish Executive. The latter on whom the responsibility for the survival of the parish community rests, and who are in a position to deal quickly with any offence committed in the parish, should be given considerable powers of summary jurisdiction.

If, however, such powers have not been conferred on them, those powers must be assumed and unhesitatingly exercised whenever conditions may demand it; for no circumstance, neither the lack of proper authority, nor reluctance to assume responsibility, nor fear of the consequences of acting without authority, can exonerate from blame a Parish Executive which, by its failure to exercise authority effectively, allows its parish, in consequence of lawlessness, disorder, or any other cause, to suffer harm which might have been prevented.

The Parish Police

The magnitude of the task facing the County Police in a war emergency will almost certainly lead to their concentration at selected places for use in mobile columns. It seems unlikely that a rural parish will be able to rely on even one special constable being permanently available in the parish.

It is, however, essential that there should be a group of men, virtually amounting to a parish police force, working under the authority of the Parish Executive, available at all times for immediate action for the maintenance of law and order; and, when necessary, to enforce the orders of the Parish Executive.

Such a group had best be drawn from among the local residents, who are familiar with the parish. The numbers required will depend largely on the extent to which the parish population is increased by refugees. It is important that the members of the group should give undivided allegiance to the Parish Executive, and learn to work as a team.

Since their usefulness will depend partly on their physical strength, fitness and energy, it may be desirable, as food becomes increasingly scarce, to keep them on a scale of rations higher than that available to the rest of the community.

Summary Trial and Sentence

Remembering that the survival of the community may depend absolutely on the disciplined and orderly behaviour of its members, and that the maintenance of good order demands the immediate checking of any deviation from accepted standards of behaviour, and brooks of no hesitation or delay in the initiation of corrective action, we may expect that any person charged with an offence which affects the life and well-being of the community will be tried summarily in the parish in the presence of his neighbours by two or more Justices of the Peace, being members of the Parish Executive. The right of appeal to a higher court is likely to be withheld, and sentence carried out without delay, except that where a sentence of death has been passed, confirmation of the sentence should first be obtained from the next higher authority, where this is practicable without unreasonable delay.

The normal forms of punishment will not be appropriate; for fines could not be levied and imprisonment would be too wasteful of man power. Thus we may have to consider other forms of punishment such as:—

- Employment on specially unpleasant and arduous tasks.
- Limited reduction, or deprivation, of rations.
- The use of the stocks.
- Corporal punishment.
- Death.

Law and Order in the Parish War Emergency Plan

Without some guidance from higher authority on the maintenance of law and order in an emergency, a detailed parish plan to cover the matter cannot usefully be made at a time when no emergency is threatening. Before the declaration of an emergency, however, some guidance may be expected.

But, in order that proper arrangements for the maintenance of law and order in the parish during a war emergency may be made, whether with the guidance of higher authority, or, failing that, on the initiative of the Parish Authority, consideration should be given to the following points in the parish war emergency plan:—

- The absolute responsibility of the Parish Executive to their parish community for the maintenance of the law and order within the parish.
- Agreement that the orders of the Parish Executive shall carry the force of law.
- The need for powers of summary jurisdiction to be conferred on, or if necessary assumed by, certain members of the Parish Executive.
- The formation and training of a Parish Police Force.

Use of Man Power

At an early stage in a war emergency it is probable that, whilst the number of people in the parish has greatly increased with the influx of refugees, and hardly any oil fuel, motor transport, or electrical energy is available, man power will be virtually the only form of energy with which to carry out all the work required for the continuing life of the community. The economical use of this man power will profoundly affect the well-being of the community.

In the pre-attack period, the labour force in the parish although possibly ill organised and lacking in cohesion is likely to be well nourished, strong and healthy; whereas in the immediate post-attack period, casualties, radiation sickness, shock and hunger may have reduced greatly the effective labour force.

For the survival of the community there are various tasks which must be carried out. It is clear that the more of these tasks which are undertaken before the parish is bereft of its mechanized equipment and transport, while electricity is still available, and the manual workers are still strong and healthy, the more chance there is of the tasks being completed. What could easily be done during the warning period, will become immeasurably more difficult if left until after hostilities have commenced.

Some of the tasks which must be undertaken, and which could be put in hand, and even completed, before we are attacked, are listed below:—

Pre-attack Tasks

- The establishment of the Parish Executive, and the organisation of the parish for control and administration.
- The establishment of a Parish Rest Centre for the reception of Refugees.
- Survey of accommodation for billeting, if not already completed.
- The provision of shelters giving protection against radiation from fall-out.
- All arrangements necessary for the provision of a supply of uncontaminated fresh water for use post-attack.
- The establishment of a First Aid Station.
- The stocking of the Parish Food Store.
- The establishment of a Parish Communal Feeding Centre, the provision of an initial stock of fuel, and the selection of staff to operate the Centre.
- The construction of communal latrines.
- The digging of graves.
- The excavation of pits for the disposal of dead animals.

During the immediate post-attack period, before the arrival of fall-out, the parish may be fully occupied with putting out fires, rescuing and tending casualties, and getting as many people and animals as possible under cover, protected against radiation from fall-out.

As soon as radiation has decreased sufficiently to allow of movement in the open for at least some hours each day, other tasks for the continued existence of the community must be put in hand.

These tasks, which will probably have to be carried out entirely by manual labour, will include the following:—

Post-attack Tasks

- The operation of the Communal Feeding Centre to provide one meal a day for every member of the parish.
- The operation of a system for the regular supply of uncontaminated fresh water.
- The guarding of the Parish Food Store.
- The operation of the First Aid Station.
- The burial of the dead.
- The disposal of carcasses of dead animals.
- Clearing of parish roads of obstructions.
- The provision of fuel, including the felling and extraction of timber.
- The production of food by farming, gardening and fishing.
- The repair of any building essential for the community.
- The organisation and operation of such load carrying transport as may be required.
- The maintenance of sanitation in the parish.
- Arrangements for the grinding of corn.
- The establishment of at least one workship for metal and wood working.

It will be the duty of the Parish Executive so to organize the man power of the parish that it may be possible to carry out the tasks listed above.

The pre-attack tasks, if they are to be completed before an attack develops, will call for very early action. Post-attack tasks include the long-term operation of those works and services on which the continued life of the community will depend. Of these, the task incomparably most important, difficult and arduous will be food production.

It will probably be necessary to divide the available labour force into teams, each with its own leader to carry out the various different tasks which must be undertaken. In forming the teams it is important that men should be selected for their suitability for the work to be done, and in particular, as far as possible, rural people should be selected for work on the farms.

Although the Parish Executive must be prepared, if necessary, to enforce the direction of labour, the formation of the teams must, as far as possible, be carried out on a voluntary basis.

In the selection of team leaders the greatest care must be taken to ensure that the men selected possess the ability and qualities of character to enable each one to lead his team successfully.

While the survival of the parish community will largely depend on the degree to which its members succeed in working together in willing co-operation, hard and continuously, often beyond the accepted limits of endurance, and without regard to self interest, the only rewards which can be offered are a meagre daily food ration, a somewhat slim chance of personal survival, and the satisfaction of work well done in making full contribution to the common weal.

The proper contribution of the Parish Executive is to give the leadership which will inspire their community to such behaviour.▲

DISASTER PREVENTION—JAPAN

by the
National Research Center for Disaster Prevention

Introduction

Japan is located to the west of the Pacific Ocean and in the east of vast Asian Continent. Owing to this geographical position, it is always under the influence of air masses of perfectly different nature and thus suffers from various disasters such as typhoon, heavy rain and heavy snow.

Further, Japan is very narrow in its territorial area, where the rivers are generally short with sharp gradient, and therefore when heavy rain occurs, we experience floods at various parts of Japan.

Japan is also very famous for earthquakes and volcanoes. We have been suffering from strong earthquakes which sometimes killed more than ten thousand persons.

Recently economically active areas of Japan are very rapidly expanding mainly in the plain areas of the Pacific coasts, particularly in some large cities such as Tokyo, Yokohama, Nagoya, Osaka and so on. In these cities public nuisances became an important problem to be solved quickly, and the Government began to prevent disasters due to the public nuisances such as air pollution, marine pollution, noise problem and soil subsidence.

In Japan, owing to its exceedingly high density of population, natural disasters once occurred may produce powerful effects on our social and economical life. An average of annual damage due to the natural phenomena amounts to about 200,000 million yen (360 yen = 1 U.S. dollar). In order to overcome these natural disasters, it is necessary to study these phenomena from various standpoints.

A direct motive for the establishment of our Center is the fact that in September 1959 the severe typhoon Vera hit the regions around Nagoya in the central part of Japan. In this case, about 5,000 people were killed mainly by the storm surges which destroyed completely the dikes of the areas of reclaimed land, where the elevation is under mean sea level. Therefore a very large area in the city of Nagoya was dipped into water and some parts were under the sea water for more than 100 days, until all of damaged dikes were rebuilt.

Our Government was astonished by this severe damage, various ways and means were considered for overcoming of such disasters, and several plans were put into practice. The establishment of our Center was one of the results of such plans, and the work of our Center was started in 1963.

Our Center has begun to make study of some of the above disasters with cooperation of research institutions of other Ministries concerned, and at the same time several basic researches are also carried out. The main results of these researches are shown in the last list.

Functions of the Center

In this Center, we deal with the subject of disaster prevention from the viewpoints of science and technology. The disasters we treat are those mainly caused by natural phenomena, such as typhoon, earthquake, heavy rain, flood, heavy snow and so on. The meanings of the science and technology mentioned here are as follows:

(1) science and technology for prevention of disasters from occurring;

(2) science and technology for prevention of expansion of the damage by the disasters;

(3) science and technology for restoration of the damage which occurred.

This Center belongs to a government office called "Science and Technology Agency" under the Prime Minister's Office. In Japan there are various Ministries in charge of disaster prevention. These Ministries treat the problems of disaster prevention politically and scientifically in connection with the respective functions of their own.

For example, Japan Meteorological Agency under the Ministry of Transportation issues forecasts and warnings of typhoon, heavy rain and other natural phenomena, and is now studying meteorological phenomena from the standpoint of improving its operation of warning and forecasting.

Similarly, Ministry of Construction deals with the problem of dike or embankment construction to prevent expected flood. In order to obtain necessary data for such construction, the research institutions belonging to this Ministry are proceeding with researches of the problems of flood and so on.

Moreover, disaster prevention regarding landslide in forests is treated in the Ministry of Agriculture and Forestry, and related studies are carried on there and at other subsidiary institutes.

As is mentioned above, the problem of disaster prevention is tackled by different Ministries from respective standpoints, and studies related to this have been carried out separately at various Ministries.

Our Government recognized that the above system was ineffective for the synthetic study of science and technology for disaster prevention, and in 1963 our Center was established to overcome the difficulty in this respect. Namely, our Agency, to which our Center belongs, is a little different from other Ministries of Japan, and our Center is permitted to act as a synthetical organ coordinating the researches of various Ministries for the purpose of disaster prevention.

Works

Test boring into deep layers at Matsuskiro

The earthquake swarm in Matsushiro area which began from August 1965 has given rise to 710,000 unfelt earthquakes in the succeeding 5 years, and this was a serious social problem.

In this respect, many seismologists and geologists of the organs concerned have come together, and with their cooperation they have been conducting coordinated studies for tracing and investigation of the tendency of this earthquake swarm. The Science and Technology Agency also has expended the special investigation expenses six times for supporting the above-mentioned studies. One of such supports was the grant in aid to the 2,000-m boring, which was executed by this Center as the main constituent since the end of 1969 when the Matsushiro earthquakes were likely to come to an end.

From observations and seismic prospectings, it was known that the focal domain of some of these earthquake swarms lies at depths shallower than 2 km in the Matsushiro basin, and accordingly it was considered that the state of the domain of foci could be directly investigated by the said boring. As the results of investigation, a number of fresh slickensides are found at the depth of 1,386 m and at larger depths. And many of old slickensides are also found, and they seem to have been made by earthquakes of ancient times. The analysis of collected cores is now going on, and much knowledge concerning the foci may be obtained by such analyses.

The test boring was done down to the depth of 1,934 m, and water was poured, by pressure, into the vicinity of the focal domain (deeper than 1,002 m). It was investigated, whether or not these two facts should induce micro-earthquakes, and whether or not the activity of earthquake faults should be stimulated. This was based on the consideration that the injected water might possible extend along crushed parts to a wide extent and facilitate the occurrence of earthquakes. Such considerations came from the fact that several years ago in Denver, U.S.A., when harmful waste solutions were by pressure injected into an underground fault plane, earthquakes came to be liable to occur. On the occasion of Matsushiro boring, about 3,000 tons of water was poured into the soil, and it seems that some influence was exerted on the motion of earthquake fault. On the other hand, analysis is going on concerning the micro-earthquake, but according to the results hitherto obtained, there is no conspicuous influence.

Weather modification

In 1968 a special study on the suppression of hailstorm was started from the viewpoint of control of cumulonimbus, and it was decided to use a non-debris rocket which was specially developed for the purpose of this restraint of hailstorm. The rocket is 80 mm in diameter, 800 mm long, and a two-stage rocket of a shape as shown in the figure, its first stage containing a solid propellant of polyurethane-type composite (I_{sp}= 180 seconds), and the container being made of fiber-reinforced plastics. When fired, the propellant burns out in three seconds, and meanwhile the rocket is already at the height of 1,500 m. Thereafter the rocket rises up by coasting flight, and soon after the cutoff of the first, the second stage is performed, and the first stage falls. The second stage continues to rise and reaches the height of 6,000 m, and in the meantime silver iodide is ignited and seeded in the layer of supercooled droplets. As the shells of the rocket, namely both of the first and second stages, are burnt while falling down and finally disappear, so there is not at all any danger due to the falling. In a shot of rocket there is contained a dose of silver iodide of 200 g, and for the experiment of hail suppression it may be necessary to launch rockets no less than 10 shots. In the present state of things, rocket launching is at the stage of preliminary experiment, and the real test of hail suppression is scheduled in the early summer of 1971.

Problems of weather modification have come to be spotlighted internationally also, and the plan of cooperation of U.S.A. and Japan in this field is now in progress.

Exploration of the ocean and Hiratsuka Branch of the National Research Center for Disaster Prevention

Recently, emphasis is laid on the exploration of the ocean internationally as well as domestically, and in Japan also interesting reports of inquiries are submitted to the Government through the Ocean Exploration Council. In the reports there are expressly mentioned the items to be adopted in the investigation of oceanic environments. As the Hiratsuka Branch of our Center has installed at a spot 1 km off the shore and in 20 m of water an observation tower which can take charge of a part of the items, the Branch is able to carry out all sorts of oceanographic and meteorological observations by means of the tower. Between this tower and the office of the Branch on shore, there are laid the cable, and all the data can be processed in an instant by the electronic computer SDS. This Hiratsuka Branch is prescribed to be utilized for common use by the persons concerned, and so this Branch is often visited by researchers of other government offices and universities. This Center has developed various meters and instruments, and among them particularly the capacitance-type ocean wave meter and the supersonic current meter are of very high performance, so that the data of tides and tsunamis can be simultaneously recorded by these meters. At the International Symposium on Tsunami, which was held last year, this problem was reported and enjoyed popularity.

Snow studies

Over the area facing the Japan Sea, we experience very heavy snow every winter. At some places near coastal plane the snow depth exceeds 2 or 3 meters, and at some mountainous regions 7 meters. Therefore, such heavy snow disturbs frequently economical and social activities of these regions.

Upon the opportunity of the heavy snow of 1963, the "Institute of Snow and Ice Studies" was established in Nagaoka, Niigata Pref., as one of the branches of our Center, and the institute with its 3 laboratories for study of low temperature has begun to make coordinated studies on the problems against snow damage. In particular, together with the development in machines for snow removal, it was found that the problem of removing snow from roads has a great economical influence also, and so the institute has started to cope volitionally with the problems in this respect. Moreover, the study of making snow melt is also being progressed steadily by cooperation with Nagaoka City and others, and the problem of freezing of high ways in winter is also being elucidated.

In this Institute, special studies, such as the problem of melting snow by sprinkling subterranean water on roadways, snowfall intensity meter using infrared rays and snow cover on an experimental slope, have been carried out. These researches are printed in 1967 in the report of the Institute, though they are written in Japanese with English abstracts.

A branch of our Center was established in Shinjo, Yamagata Prefecture. The activity of this branch is similar to that of Institute of Snow and Ice Studies in Nagaoka, but in this branch the problem of snow remover with suitable mechanical device is to be emphasized, utilizing rather large-scale technical equipments.

Large-sized simulator for earthquake experiment

The large-sized simulator for earthquake experiment which was completely installed in June this year in the Tsukuba Research and Education City has an accelerator which is at present the largest one in the world, the size being 15 m×15 m. This accelerator is capable of taking a large-sized model of the weights to the extent of 500 tons on it and of supplying horizontal acceleration of 0.55 G, and when a model of 200-ton weight is loaded on the accelerator, this can supply vertical acceleration of 1.0 G. Maximum amplitude of the accelerator is 60 mm, and as for the shapes of oscillation waves, this accelerator can represent sinusoidal waves, irregular waves and seismic waves as they are. Oil hydraulic pump is used for driving, and can be controlled from a control chamber. In order to conduct fundamental studies in earthquake engineering by making use of this simulator, the research organs concerned have successive plans, respectively, and so it is expected from various scientific fields that hereafter studies of paraseismic structure may be actively made by using this simulator.▲

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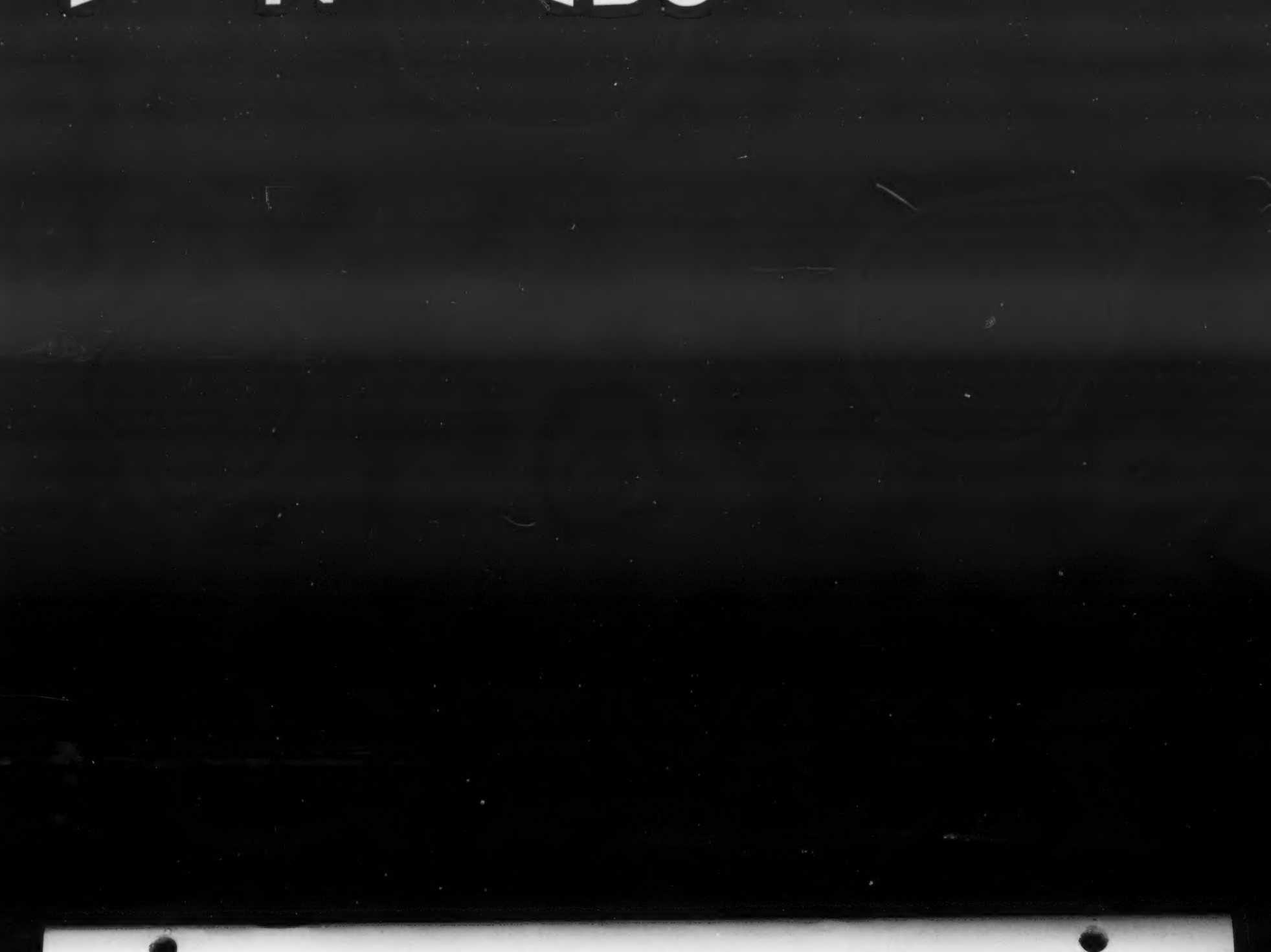
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